The State Committee for Research honors Alaska's

Northern Innovators

Jerry Johnson

Northern Innovators Hall of Fame Member

Dr. Jerry Johnson's research started with problems related to the effects of snow, ice, and frozen ground on human activities - including the physics of tire/snow interaction, neutralizing snow-covered landmines, and vehicle mobility. The research addressed problems of controlling snow avalanches using explosives, determining ice forces on offshore structures, foundation stability in permanently frozen ground, and the use of geophysical methods and geostatistics to characterize the subsurface properties of frozen and thawed ground for infrastructure development. To facilitate his research, Dr. Johnson invented penetrometers to measure snow and soil strength, a snow water equivalent (SWE) sensor to determine the amount of water stored in snow, and an ice-stress sensor. He formulated theories of penetration, ice forces acting on offshore structures and SWE sensor performance. He applied smoothed particle hydrodynamics and finite element analysis (FEA) to simulate shock propagation in snow and air and used FEA to determine the thermal regime of frozen soil. Dr. Johnson has multiple patents and has developed a model for simulating the interaction of particles that make up snow; forces on an asteroid lander during touchdown; zero-gravity and freefall tests of sample asteroid and cometary material acquisition systems, and rover wheels gaining traction on the surface of another planet.

Over the past 15 years Dr. Johnson's research has gravitated toward space science and engineering and in-river hydrokinetic energy generation. Dr. Johnson co-developed, with Dr. Anton Kulchitsky, the Coupi discrete element method (DEM) model and applied it to extraterrestrial science and engineering and renewable energy problems. The Coupi DEM is used to simulate interactions between micro-scale particles and with natural and engineered objects to determine macro-scale processes that involve material failure, large-scale deformation, and bulk material handling. This approach was used to model Mars Rover mobility, engineering designs for NASA missions to asteroids and comets, the interaction of solar wind with lunar soil, sea ice dynamics in the Arctic basin, and river debris impact on hydrokinetic infrastructure. Dr. Johnson participated in the Mars Polar Lander Mission and was a participating scientist for the Mars Exploration Rovers Science Team. Dr. Johnson also led the NASA Construction and Resource Utilization EXplorer (CRUX) project, working with 60+ scientists and engineers from seven different organizations.

Dr. Johnson currently serves as the CEO of Coupi, Inc. as well as an adjunct professor at the University of Alaska Fairbanks's (UAF) Institute of Northern Engineering (INE). Coupi is a UAF spinoff company that is commercializing research that Dr. Johnson undertook while working at UAF. In the past, Dr. Johnson has been a Research Professor at UAF's INE; Founding Director at UAF's Alaska Hydrokinetic Energy Research Center where he led studies of hydrokinetic power generation in rivers; a geophysicist at the U.S. Army Corps of Engineer's Cold Regions Research and Engineering Laboratory (CRREL); and a senior engineer at the Oceanographic Sciences Incorporated. He has also served as the scientific editor for the Journal of Glaciology, served as a reviewer for scientific journals and research funding organizations, and a judge at Alaskan science fairs.

Dr. Johnson has been awarded a Department of the Army Research and Study Fellowship, numerous Department of the Army research performance commendations, Department of the Army Superior Civilian Service Award, induction into the CRREL Gallery of Distinguished Employees, and an ERDC team award for contributions to the National Missile Defense Technical Team. He has also received a Haley Space Flight Award for the Mars Rovers Mission and a NASA (Langley Research Center) Director's Group Award for the Asteroid Redirect Mission concept study.